

Comparison of the Severity of Obsession and Working Memory in Children with Obsessive Compulsive Disorder and Healthy Children

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Abstract

Background

Obsessive-compulsive disorder (OCD) is a heterogeneous condition with distinct subtypes. This study aims to compare the severity of obsession and working memory in children with obsessive compulsive disorder and healthy children.

Materials and Methods: In this correlation-comparative study, 140 students (70 healthy and 70 with OCD, diagnosed according to Obsessive-Compulsive Inventory, child-version score) were selected through simple random sampling method in Tehran, Iran, (2018-19). The multistage cluster sampling method was applied. The subjects were selected after purposeful clinical evaluation and according to the qualifications of the study. Assessments were made using the Obsessive-Compulsive Inventory, child-version (OCI – CV), and the Working Memory Rating Scale (WMRS). Data were analyzed using SPSS software version 25.0.

Results: A total of 80 girls and 60 boys with a mean age of 9 ± 1.36 years were studied. The correlation between working memory and obsessive-compulsive disorder of girls and boys ($r = -0.482$; $p = 0.001$) at the level of $p < 0.05$ was significant. The results showed that there was a significant relationship between working memory and obsessive-compulsive disorder in girls and boys. The results of the mean and SD of the working memory in healthy children and patients were (177.24 ± 11.02), and (171.11 ± 8.08), respectively. The mean of the severity of obsession in healthy children and patients were (12.07 ± 3.97) and (9.98 ± 3.73), respectively.

Conclusion

The findings showed that the working memory scores in both girls and boys increased by reducing the obsessive-compulsive disorder accompanied. Moreover, the working memory of the healthy group was higher than that of the patients.

Key Words: Children, Obsession Behavior, Obsessive- Compulsive Disorder, Working Memory.

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1- INTRODUCTION

Obsessive-compulsive disorder (OCD) is a disorder characterized by the involuntary projection of persistent unwelcome thoughts, images, ideas, and impulses into consciousness. The patient tries to neutralize these uncontrollable mental activities (obsessions) through behaviors (compulsions) (1). OCD has a lifetime occurrence in 2% to 3% of the general population (2). With respect to gender, pediatric studies report a higher prevalence among men (70%) while studies on adults report an equal distribution across genders or a slight female preponderance (3). Diwadkar et al. suggested that deficits in working memory are crucial to a fundamental pathology of OCD (4). It might be an imbalance between long-term and short-term memory processes (5). A sufferer might be stuck in a mental loop where long-term memory is in control of their brain to such an extent that their reactions are based solely on memory without the influence of the input (rather than as a trigger for the memory) (5). The memory can be a more influential factor to consider as it appears to function as a conduit between obsessions and compulsions in OCD (6).

In recent years, OCD has been described as a form of "memory-mixing", which represents the distortions in temporal memory by the encoding of multiple signal durations into a single memory distribution (7-10). Although memory functioning may be affected, these deficits appear secondary to an executive failure of organizational strategies during encoding. On tasks of executive functioning, patients with OCD demonstrate increased response latencies, perseveration of responses, and difficulties in utilizing feedback to adapt to change (11). It was suggested that working memory deficits also contribute to compulsive monitoring, reflecting difficulties in monitoring and controlling actions (12). Jafari et al. found that in the

object comparison task, low working memory scores predicted increased control behavior (excessive visual comparison of the presented objects) (13). De Vries et al. asked OCD participants to perform an N-back working memory update during fMRI measurement. Behavioral results showed reduced accuracy rates in the OCD only with a high working memory load (14). Previous neuropsychological studies indicate that OCD subtypes might be associated with a working memory deficit. On the other hand, functional neuroimaging studies found functional abnormalities of the frontal cortex and subcortical structures in OCD (15).

Evidence from several lines of research suggests substantial neuropsychological deficiencies in OCD patients. Cognitive dysfunction and non-verbal memory deficiencies have been widely documented in OCD (16). Benzina et al. demonstrated that OCD patients have a broad variety of neurocognitive deficits in all cognitive domains (memory, attention, flexibility, inhibition, working memory, planning, and decision-making) (17). Abramovitch et al. observed that the OCD group had dysfunctions in all neuropsychological areas relative to controls. The severity of OCD had a significant association with composite performance, executive functions, and verbal domain indexes (18).

Omori et al. showed that OCD patients of the checkers subtype have impairments in memory associated with dysfunctional inhibitory control (19). Our previous research had further specified the cognitive processes that differentiate the working memory (WM) performance of high (more severe) from low (less severe) checkers (20-21). More precisely, the frequency of symptoms in OCD was found to be positively associated with brain activity (22, 23). A similar correlation between brain activity and the intensity of symptoms was observed in experiments using symptom agitation methodologies

(24). Several studies have found an important correlation between OCD symptoms and neurocognitive memory outputs (25, 26). Researches showed that the frequency of obsessions alone is significantly correlated with certain memory tests, and not that of compulsions (27, 28). Moody and colleagues observed OCD patients following cognitive-behavioral therapy and found a correlation between the severity of OCD symptoms and cognitive function (29). There is a lack of adequate knowledge and research on these variables in children. Therefore, the present study was conducted to review the previous research efforts and to compare working memory and the severity of obsession in children with obsessive-compulsive disorder children and healthy children.

2- MATERIALS AND METHODS

The present descriptive causal-comparative analysis was performed between 2018 and 2019 in the statistical population of students from 8 to 10 years old. According to the statistics of the General Office of the Department of Education in Tehran, Iran, the number of primary school students studying in two districts of the Department of Education was 81012 (40843 boys and 40169 girls). At first, the sample of the current study included 481 students (291 boys and 290 girls). This number was reduced to 140 after applying the entrance criteria. The multistage cluster sampling method was used and District 2 was randomly selected from the two.

2-1. Participants and data collection

The study began after obtaining the necessary permissions from the counseling management and the participants. A list of all the schools in the district, which included 40 schools for boys and 58 for girls, was prepared. Among these, four schools for boys and four schools for girls were randomly selected. Then, five classes

were randomly selected from each school. Finally, 10 students were selected from each class using the simple random sampling (sortation) method and questionnaires were distributed among them. After eliminating incomplete questionnaires, 140 questionnaires were analyzed. The Cochran formula with the margin error of $d = 0.05$ was used to determine the sample size.

2-2. Inclusion and Exclusion Criteria

Students with a total OCI - CV ≥ 15 were included (30). Students were excluded from the sample in the presence of psychiatric disorders, substance abuse, and personality disorders as well as head injury and medical and neurological problems.

2-3. Ethical considerations

Ethical considerations of this study included: obtaining a letter of introduction and permission from the relevant authorities, providing a full explanation of the research and its purpose for each of the participants and their parents/guardians and obtaining their written informed consent, assuring participants about the confidentiality of all research material, and respecting their cultural and traditional values. The participants could ask for the research results and determine the time and place for filling out the questionnaires. The ethical committee of this study is No (192266). OCD patients received a structured psychiatric interview (semi-structural Diagnostic and Predictive Mental Disorders Manual (DSM)-V, 2013 Persian edition).

2-4. Measuring tools

2-4-1. The OCI - CV: Foa et al. developed the OCI - CV (30), and later presented a revised version as adults' obsessive-compulsive inventory (31). This self - report inventory can be used for people from 7 to 17 years. The OCI -CV includes 21 items and six subscales: doubting/checking (five items), obsession

(four items), hoarding (three items), washing (three items), and ordering (three items), and neutralizing (three items). Subjects were asked to indicate their agreement or disagreement with each item on a three-point Likert scale (never = 0, sometimes = 1, always = 2). All the scores of these 21 items were summed up to obtain the overall score, ranging from 0 to 42. A higher score indicates more symptoms of OCD in the subjects. Three cut of points were considered in the current study: scores ranging from 0 to 14 indicated mild obsession; 15 to 28 indicated moderate obsession; and 29 to 42 indicated severe obsession in the subjects. The scores of correlated items in subscales were summed up to obtain the score of each subscale. The internal consistency reliability was 0.85 for the whole scale and ranged from 0.81 to 0.83 for each subscale. The test-retest reliability of this inventory was 0.77 (30) for all the items. In a pilot study, the Persian version of the OCI – CV was tested by Iranian researchers and its Cronbach's alpha was 0.89 (32).

2-4-2. The Working Memory Rating Scale (WMRS): The Working Memory Rating Scale (33) consists of 20 descriptions of specific behaviors of children with working memory deficits. The following are some of the examples: A child raises his hand but has forgotten his response when called; a girl misses her part in a task with multiple steps; and a child has difficulty remaining focused on a task. Teachers are asked to rate how typical each behavior is in a target child using a four-point scale: not typical at all (0), occasionally (1), fairly typical (2), and very typical (3). In the present study, the potential for error due to the use of different raters was minimized as the same classroom teacher rated both the low and average WM groups on the WMRS. All 12 tests from the Automated Working Memory Assessment (33) were administered. In addition, two verbal

working memory measures from the AWMA (listening recall and backward digit recall) were administered to the low and average WM groups. In the listening recall task, the child is presented with a series of spoken sentences, is asked to verify the sentence as 'true' or 'false', and recall the final word for each sentence in order. In the backward digit recall task, the child is asked to recall a sequence of spoken digits in reverse order. The digit span (forward and backward), and letter-number sequencing tests were administered to the low and average WM groups (33). The results were summed up and converted into a standard score to represent the Working Memory Index (WMI).

It should be noted that the digit span score in the WISC-IV is a composite of forwarding and backward digit span. However, forward digit recall is traditionally considered a measure of verbal short-term memory as the processing load is minimal. In contrast, the added requirement to recall the digits in reverse sequence in backward digit recall imposes a substantial processing load (34). The reliability coefficient of the scale was 0.85 (34). The analysis also verified the internal reliability and systemic validity of the WMRS. In Iran, Cronbach's alpha reliability coefficient and split-scale reliability of this scale were 0.77 and 0.88, respectively (35). The reliability coefficient for the full scale was 0.76 in the sample of the present study.

2-5. Extraction and integration of data

Data were analyzed using SPSS software version 25.0, descriptive statistics, Pearson correlation coefficients, and Independent t-test. Assessments of the OCD students were made using the Obsessive-Compulsive Inventory, child-version (OCI – CV), and The Working Memory Rating Scale (WMRS). The level of significance is $p < 0.05$.

3- RESULTS

A total of 140 children from 8 to 10 years old (80 girls and 60 boys with a mean age of 9 ± 1.36) were studied. Descriptive information for children, including gender and age, is presented in

Table. 1. The examination of OCD rates based on the average OCI-CV score in students indicated that 17.8%, 11.4%, and 20.7% of the students showed mild, moderate, and severe symptoms of OCD, respectively (**Table. 2**).

Table-1: Frequency distribution of the studied sample by demographic variables.

Variables	Variable Levels	Frequency	Percent
Gender	Boy	60	42.8
	Girl	80	57.1
Age	8 years	44	31.4
	9 years	47	33.5
	10 years	49	35.0

Table-2: Examining the level of OCD Based on the Overall Score Obtained by the Study Participants on the Questionnaire.

Level of OCD	Frequency	Percent
Mild (0-14)	25	17.8
Moderate (15-28)	16	11.4
Sever (29-42)	29	20.7

OCD: Obsessive-compulsive disorder.

The results showed that the coefficient of correlation was -0.346 and the alpha value $p < 0.01$. The negative coefficient indicates an inverse association between working memory and obsession, meaning those who are more obsessed have lower working memory (**Table. 3**). The correlation between working memory and obsessive-compulsive disorder of girls and

boys ($r = -0.482$; $p = 0.001$) at the level of $p < 0.05$ was significant. The results showed that there was a significant negative relationship between working memory and obsessive-compulsive disorder among girls and boys. The working memory scores in both boys and girls increased by any reduction in the obsessive-compulsive disorder (**Table. 4**).

Table-3: Correlation coefficient between working memory and obsession

Variables	Pearson Correlation	P-value
Severity obsession and Memory	-0.346**	0.001

** . Correlation is significant at the 0.01 level (2-tailed).

Table-4: The relationship between working memory and Severity obsession among boys and girls.

Variable	Groups	Correlation coefficient	P-value
Working memory	Severity obsession of girls	0.482	0.001
	Severity obsession of boys	0.892	0.001

Before the analysis, the Box test, Kolmogorov–Smirnov test, and Levine's test were certified as the assumptions necessary for statistical tests in this study. According to the Kolmogorov–Smirnov test, all the examined continuous variables were normally distributed. Also, due to the insignificance of Levine's test for all variables, it was concluded that the condition of equality of variances has not been observed (Tables 5, 6). Results of the

mean and SD in the Table. 7 demonstrate the working memory in healthy children (177.24 ± 11.02), and patients (171.11 ± 8.08), respectively. By comparing the mean scores of both of the groups, it was found that the working memory of the healthy group was higher than that of the patients. Also, the mean and SD of the severity of obsession were (12.07 ± 3.97) in healthy children and (9.98 ± 3.73) in patients, respectively.

Table-5: Results of the Kolmogorov-Smirnov test for checking the normality.

Variables	Kolmogorov-Smirnov Z	P-value
Working memory	0.878	0.424
Severity obsession	0.972	0.301

Table-6: Levene's test for Equality of Variances.

Variables	F	P-value
Working memory	0.433	0.512
Severity obsession	0.286	0.594

Table-7: Independent t-test results for comparing working memory and obsession between healthy and patients

Variables	Group	(Mean \pm SD)	t-test	df	P-value
Working memory	Healthy	177.24 ± 11.02	3.751	138	0.001
	Patients	171.11 ± 8.08	3.450		
Severity obsession	Healthy	12.07 ± 3.97	3.202	138	0.001
	Patients	9.98 ± 3.73	2.890		

SD: Standard deviation, df: Degree of freedom.

4- DISCUSSION

The aim of this study was to compare the working memory and the severity of obsession in two groups of OCD patients and healthy children. The results showed that there was a significant negative relationship between working memory and obsessive-compulsive disorder among girls and boys. Interestingly, our results are consistent with previous studies that have

correlated the symptom severity of OCD and impairment of working memory (3-7, 15, 18). Nakao et al. suggested that symptom severity and the symptom subtype such as obsession/checking might affect neuropsychological dysfunction and the related brain activities (15). In fact, high obsessions indicate an impairment in the working memory. It is noteworthy that the results show a statistically significant difference between scores of the

obsessive-compulsive disorder among girls and boys. On average, the prevalence of obsessive-compulsive disorder in women is higher than in men. Therefore, gender is a relevant factor that should be taken into account when evaluating OCD patients (3, 36). Inconsistent with our results, Lewin et al. indicated that cognitive prodromal symptoms are prevalent among adolescent OCD patients seeking treatment. Deficits in executive and non-verbal memory output have been reported but not correlated with OCD severity (37). Lambrecq et al. showed that baseline levels of visuospatial working memory did not predict the number of ambiguous conditions in patients with OCD in comparison with healthy subjects. Uncertain studies have shown a reduction in visuospatial memory capability to 65 percent in normal OCD output while remaining stable in healthy subjects (38).

Shahar et al. administered an optional response to different work memory requirements to a group of college students with or without OCD. The results suggested that the process of working-memory processing is most likely intact in OCD cases (12). As an explanation of our results, Diwadkar et al. stated that OCD is characterized by a significant increase in the dorsal anterior cingulate cortex modulation of cortical, striatal, and thalamic targets in working memory, and this abnormal increase in OCD patients is maintained regardless of working memory demand (4). These results are consistent with previous studies that reported female OCD patients had a significantly lower function in working memory (10-15). The findings of several studies provide compelling evidence that everyday activities impaired brain network connections in OCD (3) and show an important relationship between obsessions and a poor memory function (3, 39, 40). The results of this study showed differences in working memory in healthy

children and patients. A comparison of the mean scores of both groups found that the working memory of the healthy group was higher than the patients group. Moreover, the mean and SD of the severity of obsession in healthy children were lower than the patients. Gottwald and colleagues (2018) discussed the significant learning and memory impairments in adolescent OCD patients. The patients made more errors in the early stages of learning compared to the healthy subjects, especially if the disorder involved discrimination and reversal of learning. Patients were also slower to learn about uncertainties and less prone to outcome debasement, reflecting a decreased goal-oriented control (41). Other previous studies showed that significant impairments were found in OCD patients in terms of Stroop test and Wisconsin Card Sorting Inspired Task (WCST) scores compared to healthy controls (39).

Demeter and colleagues showed that in OCD patients, executive functions are impaired while short-term memory is intact. However, dysfunction in executive processes has been the most common finding in the pathophysiology of OCD (40). Saremi et al. found no significant association between the severity of OCD symptoms and neuropsychological functions and suggested that the neuropsychological deficits were more trait-like than state-like factors (25). Bragdon et al. (2018) examined comparable OCD studies and found that if OCD is characterized by an equal severity of symptoms but is highly functional related to OCD samples, it does not pose cognitive deficits (42). The presence of a relationship between the severity of obsession and working memory found in the present study is in line with the existing literature, indicating that symptom patterns do not change across children and adolescent groups (41).

4-1. Limitations of the study

The sample of the current research was relatively small and included only the adult OCD patients. Future studies are, therefore, suggested to compare neuropsychological executive functions in different age groups, especially adolescents, with a large sample size to generalize the findings.

5- CONCLUSION

According to the findings, there is a significant negative correlation between working memory and obsessive-compulsive disorder in boys and girls. The results show that the working memory and the severity of obsession in the healthy group and the patients were different. It was also found that in the healthy group, the working memory was higher and the severity of obsession was lower compared to the patients. OCD has negative effects on people's lives and overlaps with other mental disorders. OCD patients are given a tried-and-tested treatment plan in medical centers and many of the patients will be assisted. However, more studies are needed to verify these results and find the role of a supportive family in decreasing stress and help in choosing the best coping strategy.

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